

Claims

- [c1] A metrology process for increasing image contrast of a buried feature, comprising:
 - milling a selected surface of a substrate to expose a cross section of the buried feature;
 - exposing the exposed cross section with a gas mixture, wherein the gas mixture comprises a fluorine bearing compound; and
 - irradiating the exposed cross section with a high energy beam to increase image contrast of the buried feature.
- [c2] The metrology process of Claim 1, wherein the high energy beam comprises an ion beam, and electron beam, a plasma, or a laser.
- [c3] The metrology process of Claim 1, wherein milling forms a wall substantially perpendicular to a major plane of the substrate.
- [c4] The metrology process of Claim 1, further comprising recording an image of the exposed cross section at an angle from the substantially perpendicular wall.
- [c5] The metrology process of Claim 4, wherein recording the image comprises scanning electron microscopy.
- [c6] The metrology process of Claim 1, wherein the milling comprises exposing the selected surface to a focused ion

beam.

- [c7] The metrology process of Claim 1, the milling comprises exposing the selected surface to a focused ion beam and a noble gas halide selected from the group consisting of XeF_2 , XeF_4 , XeF_6 , KrF_2 , KrF_4 , and KrF_6 .
- [c8] The metrology process of Claim 4, further comprising filling the exposed cross section subsequent to recording the image.
- [c9] The metrology process of Claim 1, wherein milling and exposing the exposed cross section occurs in a dual beam exposure apparatus.
- [c10] The metrology process of Claim 1, wherein the fluorine bearing compound comprises a formula of $\text{C}_x\text{H}_y\text{F}_z$, wherein x ranges from 1 to 4, y ranges from 0 to 9 and z ranges from 1 to 10.
- [c11] The metrology process of Claim 1, wherein the fluorine bearing compound comprises CF_4 , HF , NF_3 , F_2 , SF_6 or a combination comprising at least one of the foregoing fluorine bearing compounds.
- [c12] The metrology process of Claim 1, wherein the fluorine bearing compound is less than about 80 parts by volume of the second gas mixture.
- [c13] The metrology process of Claim 1, wherein the gas mixture

comprises the fluorine bearing compound and an oxidizing gas.

[c14] The metrology process of Claim 13, wherein the oxidizing gas comprises O₂, NO, water vapor, or mixtures comprising at least one of the foregoing oxidizing gases.

[c15] A metrology process for enhancing an image contrast between an oxide layer in contact with a nitride layer; comprising: exposing a cross section comprising the oxide layer in contact with the nitride layer with a gas mixture, wherein the gas mixture comprises a fluorine bearing compound; and irradiating the exposed cross section with an ion beam or an electron beam or a plasma beam or a laser to increase the image contrast between the oxide layer and the nitride layer .

[c16] The metrology process of Claim 15, wherein the fluorine bearing compound comprises a formula of C_xH_yF_z, wherein x ranges from 1 to 4, y ranges from 0 to 9 and z ranges from 1 to 10.

[c17] The metrology process of Claim 15, wherein the fluorine bearing compound comprises CF₄, HF, NF₃, F₂, SF₆ or a combination comprising at least one of the foregoing fluorine bearing compounds.

[c18] The metrology process of Claim 15, wherein the fluorine bearing compound is less than about 80 parts by volume of

the gas mixture.

[c19] The metrology process of Claim 15, wherein the gas mixture further comprises an oxidizing gas.

[c20] The metrology process of Claim 19, wherein the oxidizing gas comprises O₂, NO, water vapor, or mixtures comprising at least one of the foregoing oxidizing gases.